

Modern Concepts of Cardiovascular Disease

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THE NEUROSURGICAL TREATMENT OF ANGINA PECTORIS

THE conception that neurosurgery could benefit the sufferers of angina pectoris originated with the French physiologist, François-Franck. In 1899 he wrote: "This new idea of aortic pain carried by the cervicothoracic sympathetic nerves suggests the thought of trying their resection in angina pectoris." Some seventeen years elapsed before this concept was put to the test by the Roumanian surgeon, Jonnesco. In reading over the account of his first case it seems as though the patient suffered from paroxysmal tachycardia rather than true angina pectoris; but in any event his pain was relieved, and as a result a large number of cases have been submitted to cervical sympathectomy. In reviewing the statistics of these operations it is apparent that only about 56 per cent were reasonably successful, and that the operation carried a mortality of 21 per cent. For this reason Coffey and Brown in this country suggested its modification to resection of the superior cervical ganglion alone. This lesser procedure naturally reduced the mortality, but it also reduced the percentage of patients relieved. Resection of the stellate ganglion through a cervical incision is still practiced on the Continent, but both operations have been largely abandoned in this country.

Thanks to Mandl in Vienna the point of surgical attack, has shifted from the sympathetic ganglia in the neck and their superior, middle, and inferior cardiac nerves to the upper thoracic rami and ganglia. To Swetlow is due the credit of demonstrating that these structures can be destroyed permanently by injecting paravertebrally small quantities of 95 per cent alcohol. White, Garrey, and Atkins have shown that destruction of the upper four thoracic ganglia, their rami, or the upper five pairs of posterior thoracic spinal roots is capable of interrupting the pain of experimental coronary occlusion in dogs. At the same time modern neuroanatomists have demonstrated direct cardiac connections of the upper four or five thoracic sympathetic ganglia. With the possible exception of the superior, all of the cardiac nerves contain large myelinated neurones which reach the posterior horn of the spinal cord over the upper thoracic posterior roots. These so-called viscerosensory neurones are identical in every way with the fibres which carry cutaneous pain sensation and should not be considered as belonging to the sympathetic

system, although they run in its trunks. The thoracic rami constitute an accessory pain pathway after the cervical sympathetic nerves have been resected. On the other hand, when the thoracic connections are all destroyed, pain is thereby interrupted—not only are the thoracic cardiac nerves interrupted, but no afferent impulses can reach the spinal cord directly from the cervical sympathetic chains (the latter must descend in the sympathetic chains to the highest central connections which lie in the white rami of the upper thoracic region).

CLINICAL evidence has corroborated these experimental findings in animals—in five patients where the posterior thoracic spinal roots have been cut bilaterally anginal attacks have ceased; in four cases unilateral resection of the upper thoracic ganglia has brought equally effective relief limited to the denervated side. Two of the latter patients subsequently died of coronary thrombosis with intense pain on the right side, but no pain was felt across the midline on the denervated left side. No better evidence could be presented for the effectiveness of this procedure. Unfortunately, operations on the spinal cord or the thoracic sympathetic ganglia carry too great a risk for the average patient with angina pectoris. On the other hand, the paravertebral injection of alcohol is a fairly satisfactory substitute. It is by far the safest form of surgical intervention, and gives really excellent results in experienced hands. At the Massachusetts General Hospital 36 patients with intractable angina pectoris have been subjected to this form of therapy. Of these, 67.7 per cent have been totally relieved (on the side injected), an additional 17.6 per cent have been reduced from the severest form of the disease to mild infrequent attacks which are easily controlled by nitrites. Only 14.7 per cent have failed to secure relief, all of these falling in the first half of the series. I believe it is fair to state that there has been no failure after a satisfactory injection, and that only one death may be attributed to the method.

The intolerable pain which is occasionally associated with expanding aneurysms of the aortic arch can also be treated by paravertebral injection of the upper thoracic ganglia. Three such cases have been entirely relieved at the Massachusetts General Hospital, and

a fourth successful instance has been reported by Reichert.

The only possible objections to this method are the technical difficulty of achieving accurate injections of four or five nerves which are situated at a depth of 6 to 9 cm. beneath the skin, and the common intercostal neuritis which follows alcohol injection. The first difficulty can be overcome by a surgeon who is doing paravertebral injections at frequent intervals. It cannot be stated too emphatically that injection therapy should not be attempted by the inexperienced! The second drawback, intercostal neuritis, causes hyperaesthesia and a burning sensation in the upper thorax in most of the patients. It usually begins about three weeks after injection and lasts one or more months. So far in our hands only one patient has regretted the injection for this reason, and with complete justification, as he had the misfortune to be one of the few failures. Although the intercostal nerves recover function rapidly, the delicate sympathetic rami are usually permanently destroyed. Our first case survived for six years without a single attack of left-sided pain—only three have shown a tendency to recurrence, and even these patients have only slipped back from complete relief to occasional mild attacks which are quickly relieved by nitrites.

COINCIDENT with the accurate knowledge of the pain pathways, reduction of the work and oxygen requirements of the cardiac muscle by total thyroidectomy has given a second satisfactory method of dealing with intractable cases of angina pectoris. Whether the duration of life in the patient who has been freed of his angina through diminished thyroid secretion will be greater than in the individual who has simply been relieved of pain is as yet unknown. While no exact indication can be given at present, certain good points stand out in favor of each procedure. Experience with total thyroidectomy has demonstrated it to be safer than thoracic ganglionectomy or posterior root section. These procedures, although most effective, carry a high rate of mortality and should, therefore, be given up. Total thyroidectomy is the operation of choice for the patient with angina pectoris superimposed on congestive failure, and also for the mild case who insists on some form of relief so that he can continue to work. On the other hand, paravertebral alcohol injection is unquestionably the best method of dealing with: (1) cases with a pre-existent very low basal metabolic rate; (2) young individuals with active rheumatic fever and aortic regurgitation; (3) patients with rapidly progressive

heart disease secondary to syphilitic aortitis; (4) old men with recent coronary thrombosis and attacks of unbearable pain. In a general way, the worse the risk and the more severe the attacks, the more clear cut are the indications for interrupting the pathways that carry pain from the heart.

Cases of severe angina pectoris of the types described above should be given the choice of paravertebral alcohol injection if their attacks cannot be relieved by routine medical treatment. The relief of suffering resulting from the destruction of the upper thoracic sympathetic ganglia and their rami is really remarkable. Life is prolonged by giving these patients rest and freedom from their dreaded attacks. Contrary to the common belief, their warning signal is rarely removed, because dyspnea, palpitation, and other peculiar sensations, in addition to mild attacks on the uninjected side persist. The procedure ordinarily causes such a slight reaction that most of these cases can be discharged to their homes from the hospital within a few days.

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SELECTED ABSTRACT

Harrison, Tinsley R.: The Pathogenesis of Congestive Heart Failure. *Medicine*, 14, 255, 1935.

In this article Harrison reviews the entire subject of the mechanism of congestive heart failure, utilizing the splendid extensive researches both clinical and experimental that he has carried on during the past 10 years. His main thesis is that heart failure of the congestive type is due to "back pressure." When of the left ventricle this back pressure is reflected in diminished vital capacity, dyspnea, cough and moisture in the lungs. When it involves the right ventricle there results cyanosis, engorged veins, enlarged liver, edema, and free fluid in the chest or abdomen. Often both sides of the heart fail.

He presents convincing support to this theory which is not new and refutes the idea that ordinary heart failure depends on "forward failure" or diminished output of blood to the tissues. This discussion is most illuminating in explaining many phenomena commonly seen in cardiac patients and contains points of view which are somewhat novel, but seem directly applicable to practical problems in the care of circulatory disease.

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